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TRANSPORT

Special Sahelian Office

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* This report has been prepared at the request of and for the Special Sahelian Office by a consultant to the International Bank for Reconstruction and Development, and the views expressed herein are not necessarily those of the Bank, nor those of the Special Sahelian Office.

74-08478

Currency Equivalents

Currency Unit	=	CFA franc (CFAF)
US$1.00	=	CFAF 250
CFAF 1 million	=	US$4,000.

System of Weights and Measures: Metric

Metric		British/US Equivalents
1 meter (m)	=	3.28 feet
1 kilometer (km)	=	0.62 mile
1 square kilometer (km^2)	=	0.386 square mile
1 kilogram (kg)	=	2.2 pounds
1 metric ton (m ton)	=	2,204 pounds

Acronyms

OCDN	-	Organisation Commune Dahomey-Niger
PISDCC	-	Permanent Inter-State Drought Control Committee
SAO	-	Special Sahelian Office

SAHELIAN COUNTRIES

STRATEGY FOR TRANSPORT IMPROVEMENTS

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SAHELIAN COUNTRIES

STRATEGY FOR TRANSPORT IMPROVEMENTS

1. INTRODUCTION

1.01 The recent drought disaster in the six Sahelian countries (Chad, Mali, Mauritania, Niger, Senegal, and Upper Volta) has caused a considerable set-back to their already slow economic development. In response, the Governments of these countries have established a Permanent Inter-State Drought Control Committee (PISDCC) to coordinate immediate and long-term relief. The committee comprises (i) a Conference of Heads of State, and (ii) a Council of Ministers in which each member State is represented by one or more Ministers. Its function is to coordinate at the sub-regional level all action to combat the drought and its consequences, and to appeal for, and mobilize the resources necessary to finance and carry out programs and operations to improve the economies of its member countries.

1.02 One of the committee's first actions was to appeal to the United Nations for assistance, and this has resulted in the creation of the Special Sahelian Office (SSO) within the U.N. organization. The main tasks of the SSO are: (a) to assist in developing a coherent medium-and long-term program that reflects the needs of the Sahelian countries; (b) to coordinate the technical and financial resources of the United Nations system; and (c) to cooperate with bilateral and multilateral sources in promoting coordination of their assistance programs. The SSO has called upon the Bank Group for general assistance in executing these tasks, and in particular has requested a report which would review the transport situation within the six countries and connections with the rest of the world, and recommend a broad medium- and long-term strategy for improving the transport system in the region.

1.03 The present report has been prepared in response to the above request. It is based upon information available within the Bank Group, and on discussions with other lending institutions. The report is not exhaustive, since only limited time and information were available; and it is recognized that there will be exceptions to the broad strategy recommendations.

2. BACKGROUND

A. Topography

2.01 The six Sahelian countries lie in a band stretching 4,000 km across western Africa between the latitudes of 10° and 25°N (Map 10604R). Together they cover some 5.3 million km², equivalent to about 60% of the land area of the United States. However, more than half of this is desert, and an additional 20% receives in a four-month rainy season less than 500 mm of rainfall, an amount barely marginal for crop production. Only about one-third of the total area gets enough rainfall to support permanent systems of rainfed crop production.

2.02 The environmental characteristics of the region are simple. The topography is flat, and soil variation is slight. In the summer, rain-bearing southwesterly winds blow from the South Atlantic, and in the winter they are replaced by dry northerly or northeasterly winds blowing from the Sahara. There is a close correlation between latitude and the length of the rainy season, the variability of rainfall, and total rainfall. The pattern becomes less favorable northwards from the coast. The principal zones represented in the area are, from north to south: the Sahara Zone with less than 250 mm of rainfall, the Sahel Zone, 250-500 mm, the Sudan Zone, 500-1,000 mm, and the Guinea Zone, with over 1,000 mm (Table 1). The Sahara is not represented in Senegal and Upper Volta; these two countries, and also Chad and Mali, have substantial areas in the Guinea Zone (Map 10604R). Unfortunately, annual variations are most pronounced in areas with the lowest averages.

2.03 The Sahara accounts for about 50% of the area. Apart from its oases, this desert is of little economic importance as an agricultural resource.

2.04 The Sahel comprises about 20% of the area. It is typically a tree and shrub savanna. Crop production is possible in this zone: millet is grown under conditions of as little as 125 mm of rainfall, and groundnuts with as little as 400 mm, but yields are very low. Pastoral operations are the most important economic activity, and under normal conditions, nomadic pastoralists in the zone maintain some 19 million cattle, 29 million sheep and goats, and about 3.3 million camels, horses and donkeys. For the nomadic graziers, the Sahel represents a base which provides adequate forage for their herds for about four or five months of the year; thereafter, the herds are moved southward to graze in areas which, while better watered, present disease hazards in the wet season. However, a substantial number of breeding females and young stock remain in the Sahel in a normal dry season.

2.05 The Sudan Zone can support quite intensive systems of agriculture. Since health conditions are favorable compared with the Guinea Zone to the south (para. 2.06), the Sudan Zone supports the bulk of the population of the six countries; indeed, in areas such as the Mossi Plateau in Upper Volta and the groundnut basin in Senegal, population pressure has developed to excessive levels. Over most of the zone, millet, sorghum and cowpeas are the principal food crops, and cotton and groundnuts the cash crops. There are substantial possibilities for further diversification into food crops such as maize and soybeans, and since pasture growth is better than in the Sahel, mixed farming is possible and is being developed in some areas.

2.06 The Guinea Zone has more diverse vegetation, but it also has the problem of a year-round incidence of trypanosomiasis, and a high incidence of river-blindness in areas in or towards the south of Mali and Upper Volta, as well as of other diseases. Historically, the disease problems in this zone have acted as a barrier to the permanent southward movement of people and livestock.

2.07 Cutting across the three main eco-climatic zones are three great river systems: the Senegal, the Niger, and the rivers which feed into Lake Chad. The Niger and, to a lesser extent, the Senegal extend the agricultural area further north than rainfall normally would permit, although only a small fraction of the river water is used for irrigated agriculture. Mainly, the rivers support either the cultivation of rice under uncontrolled flooding, or flood-recession cropping systems under which crops are planted as the annual floods recede, and grow to fruition on water retained by the soil. Yields are low.

B. The National Economies[1/]

2.08 The economies of all six countries are dominated by agriculture and livestock production. Only in Senegal have sectors such as industry and tourism been developed to some degree, and Mauritania is the only country where mining is important. Urban populations are small: 29% in Senegal, and no more than 10% in the other countries, with only 5% in Upper Volta. Total population of all the countries is estimated at about 23 million as follows: Chad, 3.6 million; Mali, 5.0 million; Mauritania, 1.2 million; Niger, 4.0 million; Senegal, 3.9 million; Upper Volta, 5.4 million. About one-quarter of the population are nomads or semi-nomads. Population growth is highest in Niger, at an estimated 2.9%, and lowest in Chad, at 1.8%. A map showing the distribution of population in the region is attached. Some principal economic statistics are given in Table 1.

2.09 All six nations are poor. Chad, Mali, Niger and Upper Volta are particularly so, each with a per capita Gross National Product (GNP) of less than US$100, and therefore among the world's 25 poorest countries. Mauritania has a per capita GNP of about US$140 which is growing relatively rapidly, but about half of this figure accrues from mining operations in the extreme north of the country. For the 85% of the population in the rural economy --70% dependent on livestock and 15% on agriculture-- GNP per capita is only about US$52. Senegal, with a GNP per capita of about US$230, is the richest of the group; but despite its fairly diversified economy, the country still depends on agriculture for 30% of GNP, 50% of exports, and 80% of employment; economic growth per capita has been virtually at a standstill between 1960 and 1970. In the other countries, the contribution of agriculture and livestock to GNP is: Chad 46%, Mali 44%, Mauritania 38%, Niger 58% and Upper Volta 49%.

2.10 The growth rate of GNP per capita for the six countries over 1960-70 was estimated on average at about 1.2%, ranging from 4.5% for Mauritania to -2.0% for Niger. These figures compare with an average population growth of 2.2% per annum in the countries (Table 1). The generally poor performance of

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1/ Data used in this section are for 1970.

the economies is due to the virtual stagnation of the livestock and agriculture sectors. Among the other constraints are poor soils, few known natural resources, diseases, low education levels of the population --factors which all lead to small domestic markets.

C. Agriculture and Livestock

2.11 Because of the pattern of rainfall, agricultural activities in all the countries are similar at any given latitude. Moving from north (the fringe of the Sahara desert) to south, the generalized pattern is as follows:

- Livestock-raising: extensive herds of camels, cattle, sheep and goats owned by nomadic pastoralists. Staple foods are milk and meat.

- Subsistance agriculture: millet is the principal crop and staple food; some domestic livestock such as goats and chickens. Yields and productivity are low.

- Sorghum/millet, cowpeas and groundnuts: sorghum replacing millet as rainfall increases; cowpeas are an important protein food; groundnuts are the only cash crop; some use of fertilizers and animal-drawn equipment.

- Sorghum/maize, cowpeas, and cotton: cotton replacing groundnuts as the major cash crop with increasing rainfall; scope for maize to replace sorghum; greater use of fertilizers and pesticides, and of animal-drawn equipment.

Irrigation-based agriculture may be found in river valleys, usually with rice the principal crop, together with subsidiary crops such as sugar-cane and vegetables.

2.12 Since the countries all produce basically the same items, little trade is generated among them. There is very light intra-regional traffic from areas with food surpluses to those with deficiencies. Much of agricultural production is consumed on or near the farms, and because of the absence of large urban centers, domestic transport of food is not significant. Although some of the neighboring countries south of the Sahelian region have larger urban centers, they also produce the same crops and could by and large be self-sufficient for food supplies. Only Mauritania, with very little arable land, imports food, but it can afford this now because of foreign currency earnings derived from its ore mines. In summary, the only cash crops which now demand international transport at reasonable cost are groundnuts and cotton. The prospects for developing additional export cash crops are very limited because of adverse climatic conditions.

2.13 There is a growing market in the coastal countries for livestock from the Sahelian region. Most animals are transported on the hoof, however, and this is likely to continue if for no other reason than that production is widely scattered. It may be uneconomic to develop concentrated road or rail routes specifically for livestock transport because of the very long distances within the countries. Loss of weight during transport on the hoof to slaughter-houses within each country would in many cases be even greater than during transport direct to markets in the coastal countries. The logical location for most slaughterhouses would therefore be in these countries, near consumption areas.

2.14 The situation may become different for exporting meat from slaughterhouses within the Sahelian countries to international markets outside West Africa, if and when they develop. This will depend on success in fighting diseases. A change from nomadic livestock practices to ranching would contribute to these prospects. For meat, air transport may well be the most economic transport mode; although air freight is more expensive than road or rail and ocean shipping, time savings on "capital in the pipeline" may more than offset the difference in freight cost. (It has already proved economical to fly fruits and vegetables from the East African countries to European markets.) Present high meat prices may make air transport economical, particularly since use of this mode reduces the refrigeration problems inherent to land and sea transport.

D. Mining and Industry

2.15 Exploitation of iron ore in the north of Mauritania is the only major mining operation within the Sahelian countries. The industry is adequately served by the MIFERMA 1/ railway which was privately built as a captive infrastructure exclusively for the iron ore mining. Because of its location in the unpopulated north, the prospects for other significant uses of the MIFERMA railway are remote, as are the prospects for commercial use of the mineral port at Nouadhibou.

2.16 Other mining operations within the region are of little consequence, and their contribution to its economy are negligible. Explorations have shown, however, that there are prospects for larger-scale operations. The most promising is the exploitation of manganese deposits near Tambao in the extreme north-east of Upper Volta which, if proven economically feasible, may lead also to economical exploitation of limestone deposits in the same area. Another prospect is for increased mining of uranium deposits near Arlitt in northern Niger. The construction of transport facilities for these projects can be justified only as part of the mining operations.

E. Impact of the Drought on the Economy

2.17 Farmers in the Sahelian countries normally maintain the levels of food reserves needed to carry their families through one or more years of drought such as occurred in 1972. The recent disaster was caused not only by low rainfall in that year, however, but was greatly aggravated by a lack of rainfall as far back as 1968 and 1970. The cumulative effect has depleted food reserves, and greatly lowered the normal water-table in the area. In addition, the three major river systems failed to flood in 1972, making it impossible to implement flood-recession cropping, and greatly reducing irrigation. As soon as the nomadic pastoralists became aware that the 1972 rains would be inadequate, they started an early and massive migration southward. Nevertheless, substantial numbers of livestock have been lost.

2.18 The drought conditions have led to a concern in all six countries that the Sahara is advancing southward, and that this may have a further adverse affect on weather patterns. This concern, together with the fact that many people have lost their livelihood, may cause many refugees not to return to their original locations; this could in turn lead to a redistribution of population and of social structures. The economies of the countries are now badly affected by a combination of loss of tax revenues, new demands on already restricted

1/ Mines de Fer de Mauritanie.

budgets, limited trained manpower to cope with the emergency, and a switch from concentrating on development to implementing measures to attain the status quo ante.

F. Implications for Transport

2.19 The physical environment and economies of the Sahelian countries as described above, and the impact of the drought, have several implications for transport policy planning in these countries.

2.20 Their recent achievement of independence has created a considerable change in intra-regional and international transport conditions. New frontiers have been created, and four of the six countries are now land-locked. Interests which used to be regional have been replaced by national interests, which are not necessarily the same. This fact is reflected in transport infrastructure and operation in each of the countries. Whereas formerly they were all under one (French) umbrella, four of them are now dependent on neighboring countries for international transport. The transport systems of all the countries in the West African region have not yet adjusted to this new situation, with possibly adverse effects on economic development.

2.21 The high cost of transport is claimed as a major cause of slow economic development of these countries. This may be true, but it must be noted that the unfavorable climatic and hydrological factors would not be improved by having the best possible transport system. Even if a perfect system existed, much would still remain to be done in the production sectors before it could be utilized fully. Packages of services (such as agricultural extension, credits, input supplies, marketing and, above all, education and training in modern agriculture and livestock management) are needed to help lift the region's thin, widely-scattered population from a subsistence to a money economy. The major need in the transport sector in the region is to fully utilize and maintain the existing infrastructure, both within the Sahelian countries and in their neighboring transit countries.

2.22 The permanent relocation of some nomads as a result of the drought may have a modest but lasting effect in altering traffic flows in the region.

2.23 The PISDCC and other relief organizations have encountered substantial transport bottlenecks and disruptions during recent relief operations, and there is understandably a tendency to be interested in transport projects which could alleviate these problems. There are, however, three important points which both the PISDCC and its donor institutions should keep in mind when preparing medium- and long-term transport projects for accelerating economic development:

(a) there is little relation between normal traffic flows and those for the relief operations, when food had to be brought into areas where it is not normally required;

(b) the failure of harvests was already foreseen in mid-1972, and many of the transportation problems encountered during the 1973 rainy season --including impassable roads and heavy demand for port facilities, railway services, and trucks-- would not have occurred had relief measures been started earlier. This would have enabled such operations to be completed well before the beginning of the rainy season by spreading the demand for transport;

(c) for medium- and long-term transport planning, the land-locked countries are dependent also on improvement of transport infrastructure and operations in neighboring coastal countries.

There is a danger that transport planning might be directed specifically towards removing the bottlenecks recently experienced, but these need not reoccur if future relief operations are planned ahead of time, and they could be accommodated by a regionally devised transport system which is geared to normal rather than to emergency demand.

2.24 In order to accelerate economic development in the Sahelian countries, it will be important to build up savings and foreign currency earnings by increasing the yields from cash crops, and improving livestock-breeding. These measures can be taken within each of the countries, as well as within the region as a whole, and PISDCC can play a leading role in the latter case. The situation is different for transport, however, because the region is so greatly dependent on neighboring countries to transport its production of cash crops and of meat, and these transit countries are not represented in the PISDCC, a problem which is considered in Chapter 3 of this report.

3. THE EXISTING TRANSPORT SYSTEM

A. Description

3.01 The transport system in the Sahelian countries consists of three levels: (a) domestic traffic within each country; (b) intra-regional traffic between the countries; and (c) international traffic with the rest of the world.

3.02 With regard to domestic traffic, because of the relatively small urban population, most agricultural products except cash crops are consumed close to production areas. Cash crops are moved as domestic "first stop" transport to collecting centers from which they become international traffic. Therefore, purely domestic traffic is low in volume and travels only a short distance. This traffic is also seasonal, and because of the dispersed population, many routes are required which are only lightly travelled, averaging just a few vehicles per day on an annual basis. In general, only tracks or cheap low-standard roads can be economically justified for most farm-to-market transport. Actually, many commodities are carried by animals, and this may continue to be the most economical mode for some time to come.

3.03 In the whole of Africa, only some 6% of total trade is between African countries. There are several explanations for this, such as credit and currency problems, lack of confidence in the quality of products, low purchasing power, etc. One very important factor is also that many African countries produce the same or similar products. This is particularly true for the Sahelian countries, and as a result there is little trade between them.

3.04 For the international trade which is so important for strengthening the economies of the four land-locked countries, the access routes to ports in neighboring transit countries are of primary importance. For medium- and long-term transport planning, emphasis should be placed on projects which would lead to the lowest cost of transport to ocean ports. PISDCC, the donor countries, and lending institutions should all realize that sacrificing economic for political goals may result in a considerable waste of scarce resources both for investment and for the maintenance of underutilized infrastructure. For example, asphalt roads are generally expensive to build and to maintain, and are justified only if used by several hundred vehicles per day (para. 3.11).

Transport Modes

3.05 The existing transport system of each of the six Sahelian countries is described in the Annex. The river, rail, and primary and secondary road systems of the West African region as a whole are summarized in Map 10829; it should be noted that an extensive tertiary road and track system is not shown, nor are several additional international and domestic airports, and numerous air strips. A comparison of this transport map with that showing the distribution of population shows that the system as a whole is reasonably comprehensive, provided its various components are efficiently used, operated, and maintained. Conditions are favorable for animal-carried and animal-drawn first-stop transport. Moreover, topography and soil conditions in general allow the use of four-wheel drive vehicles over tracks, and even in untracked areas outside the rainy seasons.

3.06 The major transport problem is the long distances encountered, both within some of the Sahelian countries and between the north of the Sahelian belt and the coast, some 1,200 km as the crow flies, and of course, considerably longer along the surface routes. Little can be done about this, except to encourage the present trend for the francophone Sahelian countries to look to the shortest access routes, even if they lead through anglophone countries (para. 3.38). Priorities are still not always clearly established, however. For example, the promising Maradi area of Niger is only 120 km away from the railhead at Kaura Namoda in Nigeria, and the railhead at Nguru in the same country is only 80 km away from the 1,600 km Chad-Zinder-Niamey road, presently being improved to a two-lane asphalt road; however, the roads leading to these railheads are in rather poor condition.

Railway Transport

3.07 There are no railways in Chad or in Niger, and the one in the north of Mauritania is of little commercial consequence other than for the requirements of the iron ore mining industry. Senegal is traversed by a railway which also connects western Mali with the Senegalese port of Dakar; the capital of Upper Volta is also connected with Abidjan in the Ivory Coast by a railway that is jointly owned and reasonably efficient. In general, the areas served by the railways (which have few branch lines of any consequence) are small compared with the vast expanse of the Sahelian countries; as a result, there is continuous pressure to expand the railway systems. However, as a rule of thumb, construction of a new railway line is justified only if the expected traffic would total, at the very least, some 500,000 tons per kilometer of line per year. The traffic volume justifying short railway extensions or new branch lines may be somewhat less, provided the goods moving on such lines would continue over considerably longer distances on existing lines. Table 2 shows that agricultural production in the land-locked Sahelian countries, and the related volumes of exports and imports, is relatively low and widely scattered. Even when other traffic (of which petroleum products form a large share) is considered, the overall volume of movements does not justify construction of new railways either at present or in the foreseeable future, except possibly where a railway would serve a mining operation and is required as an integral part of that undertaking. Table 3 shows a comparison of transport costs by road, rail, and river for various traffic densities. It demonstrates clearly that road transport costs are lower than those for rail for low density movements. On the other hand, where existing railways can be used over considerable distances, then the marginal cost per ton-km should in general be considerably lower than for road transport, provided the railways are efficiently managed and operated, and the quality of service offered is satisfactory.

3.08 Most railways in West Africa are inefficiently operated and managed. Improvements in this respect could increase the capacity of several lines without need for large investment. This would in turn reduce financial losses, and eventually lead to better service at lower cost. Where systems serve more than one country, joint ownership and/or management (already the case for the Ivory Coast/Upper Volta and Dahomey railways) should lead to greater efficiency, better service, and sounder pricing policies. The absence of branch lines make the railways highly dependent on road transport as feeders, and as a result, coordination is needed between these modes.

Road Transport

3.09 Road transport has many advantages over rail transport, particularly for countries at an early stage of development. This is primarily because:

(i) the fixed cost of a railway infrastructure is at least some US$125,000 per km in easy terrain, and stage construction is not feasible, leading to very high cost for initially low traffic densities. Roads may be built for about US$5,000 per km for a simple track, US$20,000 for an all-weather earth road, or US$75,000 for an asphalt-paved two-lane highway in relatively easy terrain. Stage construction is quite feasible, and is in fact common practice;

(ii) road vehicles are not tied to only one or a few routes, and are therefore more flexible to use than rail equipment. Moreover, since the economic life of road vehicles is much shorter than of railway equipment, different types can more quickly be adopted to meet conditions or improved technology; and

(iii) the burden of Government investment is much lower for road transport, not only because of the possibility of stage construction of roads, but also because vehicles are normally privately purchased; in other words, private capital will be available for road transport, whereas today it is not generally available for rail service.

3.10 There is, however, one problem inherent to road transport in most developing countries. Roads are not properly maintained, a situation which is aggravated by excessive vehicle loads. This results from a lack of funds, deficiencies in the organization and operation of road maintenance departments, and poor enforcement of weight limitation. These problems are frequently used as an excuse to justify constructing expensive asphalt roads not warranted by traffic volumes. It is often thought that, once a road is paved, maintenance costs will be lower. This is a fallacy, since proper maintenance (particularly drainage) and weight control are important to prevent the pavement from breaking up. Deteriorated asphalt pavements cannot be graded, and are much more difficult and expensive for vehicles to negotiate than are properly graded tracks or earth roads. Particularly in hot climates, resurfacing of asphalt roads is needed every six to ten years, regardless of traffic density. This alone costs some CFAF 1 million per kilometer, or an average of about CFAF 100,000-150,000 per kilometer per year. Moreover, asphalting a road eliminates the possibility of strengthening its foundation and pavement by gradually adding additional layers. To reduce initial costs, many asphalt roads in developing countries have been and still are being built with inadequate drainage and foundations, and this causes fast deterioration and high repair costs. It is often thought, and wrongly, that asphalting a road allows its use all year round, but this is true only if both drainage and foundation are properly designed. This makes for prohibitively high costs for roads which may carry only 100 vehicles a day. For agricultural extension projects, it is good policy to construct farm-to-market roads, and to include their maintenance during the first three or four years. In the case of low-class roads, once they are improved, their maintenance should be made the permanent responsibility of local administrations or cooperatives which have a direct interest in their upkeep.

In general, road construction in poor countries should not be undertaken on the assumption that governments will maintain them properly. The present financial position of the Sahelian countries may make commitments of this type almost impossible to keep.

3.11 The following table gives some idea of road costs for various traffic volumes and construction standards. It demonstrates clearly that for low traffic densities, the operating cost of vehicles is only a fraction of the total economic cost of road transport.

Representative Road Construction and Vehicle Operating Costs in The Sahelian Countries

	Asphalt	Gravel	Laterite/Earth	Improved Tracks	Non-maintained Tracks
			(CFAF thousand)		
Construction cost per km	18,000	8,000	4,000	2,000	
Annuity, including 10% annual interest: asphalt 25 years; gravel and earth 15 years; improved tracks 10 years.	1,980	1,050	525	325	
annual maintenance cost (without taxes)	220	125	100	50	
Total Annual Road Cost	2,200	1,175	625	375	
Road cost per ton km			(CFAF)		
using 10-ton trucks with average load factor of 70%, for an annual average of ton/year					
2 trucks/day 5,000	-	-	-	75	
5 trucks/day 12,500	-	-	50	30	
10 trucks/day 25,000	88	47	25	15	
20 trucks/day 50,000	44	23	12.5	7.5	
50 trucks/day 125,000	19	9	5	3	
100 trucks/day 250,000	8.8	4.7	2.5	-	
250 trucks/day 500,000	4.4	2.4	--	-	
Vehicle operating cost (without taxes) per ton km	6	9	12	15	40-50
Total road transport cost per ton km					
for 2 trucks/day	-	-	137	90	
5 trucks/day	-	-	62	45	
10 trucks/day	94	56	37	30	
20 trucks/day	50	32	24.5	22.5	
50 trucks/day	25	18	17	18	
100 trucks/day	14.8	13.7	14.5	-	
200 trucks/day	10.4	11.4	13.3	-	

The following example serves to put the above figures in perspective. An agricultural extension project in Niger, now under preparation for IDA financing, aims for a total production (excluding livestock) by 1980 of about 200,000 tons from a cultivated area of 38,700 km^2 (about the size of the Netherlands). About half of this production is to be consumed locally. It is therefore obvious that the transport tonnages on each of the secondary and farm-to-market roads will be at the low end of the scale.

3.12 Road construction costs and vehicle operating costs vary considerably throughout West Africa, and the figures cited above represent only rough averages. Vehicles other than trucks are also assumed to be included as truck equivalents. Because of generally favorable soil conditions, jeeps and landrovers are able to negotiate simple tracks most of the time, and therefore for low-class roads, construction standards are determined by requirements for trucks. In any event, figures in the above table demonstrate that for low traffic densities, the road costs amount to several times those for vehicle operation, excluding taxes (which are supposed to pay for the road). If about 30% in taxes were added to vehicle operating costs, road costs would be covered only if traffic densities reached the equivalent of about 80 trucks per day on earth roads, or about 200 vehicles per day on gravel roads. The conclusion is that considerable traffic volumes are required to justify upgrading existing roads or tracks on the sole basis of savings in vehicle operating costs. On the other hand, traffic of only a few trucks is needed to justify maintenance and/or improvement of tracks which are not presently maintained.

3.13 The figures also demonstrate that in low traffic areas, it may be more economical to use light vehicles carrying only a few tons, or special vehicles such as half-trucks or trucks with balloon-tired wheels. Such vehicles have the advantage of being able to move even where there are no tracks. They will be more expensive to buy and operate than regular trucks, but this additional cost will still be considerably lower than that of road upgrading if traffic densities are low; it is therefore unfortunate that automotive manufacturers show little interest in producing them. A practical problem in using such vehicles, however, is that their higher cost is borne by the owner, whereas the savings resulting from not constructing a road benefit the economy as a whole. The transporter considers only his own out-of-pocket cost, since he is less concerned about economic savings which do not accrue to himself. This puts pressure on Governments to build roads which are not economically justified, a problem which is difficult to resolve. Consideration might be given to encouraging the use of special vehicles in the Sahelian countries by making them tax-exempt.

3.14 Roads, of course, meet social and administrative needs which extend beyond the primary transport function. But building two-lane asphalt roads to meet these needs is a luxury these countries can ill afford, unless the roads are also supported by an economic level of traffic movements.

3.15 Technical assistance is urgently needed to improve maintenance organizations and operations, in part to extend the seasonal period during which low-cost roads are passable. Drainage improvement is of high priority, since without this, proper maintenance is virtually impossible. If drainage is adequate, then regular grading will go a long way towards keeping tracks, earth and gravel roads passable at economic speeds during most of the year. Emphasis should be placed on gradually improving existing roads and tracks to a standard at which they can be routinely maintained. This type of betterment is most efficiently carried

out in conjunction with normal maintenance operations. It may not always be justified to improve roads over their entire length; a substantial economic return can usually be achieved by providing better drainage in low areas, and localized surface improvements, because the cost of these works is quite low.

3.16 Simple localized betterment operations can often be efficiently carried out by force account as an extension of normal maintenance activities, and by using the regular highway maintenance staff and equipment. Since such works can most conveniently be financed through the current budget, a contribution of technical assistance and funds earmarked for maintenance and betterment within the current budget would, in many cases, be the most useful aid foreign donors could provide.

3.17 It is recognized that there will be occasional difficulties in controlling specific funds within a current budget. However, the amounts involved are typically modest. For example, Mali spent in 1971 a total of about US$8.1 million on highways, of which US$6.4 million was capital expenditure, and US$1.7 million current expenditure. Over the past six years, the country has received an average of about US$3-5 million p.a., (or about 70-80% of its capital expenditures on highways), largely for upgrading roads. In this context, it is clear that budget assistance of US$1-2 million p.a. would do much to enable simple betterment works, provided that extensive technical assistance was provided simultaneously to the highway department to help ensure proper use of the funds.

3.18 Because of the important role which road transport can play as a feeder to the railway systems with only a few branch lines, consideration might be given to permitting railways to enter the trucking (and busing) business, in competition with but not supplanting private enterprise. Better coordination between railways and their feeders should eventually lead to greater efficiency in trans-shipment, and, by making better use of spare railway capacity, should also lead to lower transport costs.

River Transport

3.19 The Sahelian Region is traversed by three river basins: the Senegal river and its tributaries in the west, the Niger river system in the center of the region, and the rivers feeding into Lake Chad in the east. For freight transport over long distances, the operating cost per ton-km by river is considerably lower than by either rail or road, particularly for low-value bulk goods. The longer river routes will in many cases be more than offset by the lower transport cost; moreover, because the cost of infrastructure is relatively low, the cost per ton-km for river transport is less sensitive to traffic densities (Table 3). It is therefore unfortunate that year-round through traffic on the rivers is impossible because of low and unreliable rainfall, together with the incidence of rapids and rocky outcroppings in localized areas.

3.20 Many studies have been made to investigate the economic feasibility of making the river systems navigable, several of them as part of feasibility studies for multi-purpose dam projects for production of power, for irrigation, and for improvement of navigation. In general, however, there is the danger that if lack of sufficient demand for power implies that such a multi-purpose project is not economically justified, then the irrigation and navigation aspects are ignored. It should be kept in mind that irrigation and navigation may be served also, and possibly better, by other means than the construction of expensive dams, and this

possibility may warrant independent study. Canals with locks with low water-level differentials may circumvent rapids, and serve irrigation as well. A 1970 study by consultants NEDECO (Netherlands) concluded that lifting the bridge at Malanville and blasting rock outcroppings at some locations could make the Niger river downstream of Tillaberry navigable during some seven months of the year for barges with a draft up to 1.5 meters. This possibility was tested in 1973 under the sponsorship of the Canadian Government, and the test will be repeated in 1974. Reports indicate that stream velocities in a few locations would still create problems, but this might be overcome by a modest dam and lock project.

3.21 A continuing problem for the Niger River and for most of the Senegal River, however, will be the unreliability of flows in years of low rainfall, and the phenomenon that it takes several months for the maximum flows to move down river. For instance, the rains at the source of the Niger River in Guinea begin in April, and at Bamako (Mali) the peak flow is in May; but then the flow is retarded by the "interior delta" between Mopti and Tombouctou where the peak flow is in December, and in Niamey (Niger) the peak occurs in February, in the middle of the dry season.

3.22 Also, because the river systems would be navigable only during part of the year, say about seven months for the Niger River, products for transport would need to be stored during all or part of the other five months. This would still be quite acceptable in the case of certain bulk commodities such as minerals, but present high interest rates for "capital in the pipeline" may make seasonal river transport unattractive for high-value goods.

3.23 It would be highly desirable, however, to arrive at a definite decision on the extent of economic prospects for river transport, since the continuing uncertainty makes decision-making on alternative transport routes more difficult. To make a reasonably accurate traffic forecast for river transport with so many uncertain factors will, however, be a difficult exercise; moreover, as mentioned earlier, the cost of river transport is in general much less sensitive to traffic densities than that of road or rail transport. If the costs of some modest improvements are relatively low (and indications are that they would be for the section of the Niger River downstream from Niamey), then it may well be justified to go ahead with such low-risk projects. A component of any such project should be the building of some prototype standard barges, with a design based on conditions likely to prevail after the improvements are made.

3.24 There is one aspect which all donors should keep in mind, namely that for reasons of hydraulics, all studies pertaining to any of the three river basins should be centrally reviewed and coordinated by hydraulic experts. Every river project is likely to have a considerable effect on the flow patterns of a river over long distances, both upstream and downstream; this is particularly true for rivers with flat slopes which show large annual and seasonal variations in flow. It is therefore dangerous to divide studies between several consulting firms, some of which may lack experience in hydraulics. There should be one consulting firm specialized in hydraulics for each of the three river basins, and that firm should have overall responsibility to investigate the effects individual projects may have on the river system.

Aviation

3.25 Air services were used extensively during the recent emergency relief operations, but the need for these services may not arise in the future if foreseeable relief measures are initiated in timely fashion. It is often said that aviation is too expensive a transport mode for all but a few high value commodities, and in most cases this is true. As with specialized road vehicles, however, the operator bears the total cost of such transport. Where traffic flows are light, air services although still expensive, may be cheaper than constructing a road. The cost of aviation infrastructure is relatively low, in particular if service is limited to daytime flights in favorable weather conditions. Many countries at an early stage of development have been opened up by aviation, and even today this mode is extensively used in remote areas such as in northern Canada. For high-value commodities such as fruits and vegetables, textiles and clothing, and medicines, aviation has created its own markets, not only for transporting goods which previously moved by surface, but also for goods which previously did not move at all. High costs per ton-km are partly offset by shorter routes, savings in packaging, flexibility, and savings in interest on capital in the pipeline. In the Sahelian area, several factors are favorable for aviation: good weather conditions; soil conditions suited to the construction of cheap landing strips; thin and widely dispersed populations leading to a proportionately high infrastructure cost of alternative means of surface transport; long detour distances necessary for surface transport to market centers both in the West African region and abroad. In summary, the economic cost of aviation for a number of commodities may be over-rated, and its potential under-rated, and a fairly dense network of simple air-strips might well be justified. This would be possible, however, only if aviation services were to be subsidized on routes where low-density land transport does not yet warrant the expense of constructing new roads and maintaining them.

3.26 The above observations are not meant to imply that there is a very large potential for aviation in the Sahelian region. It may well be worthwhile, however, to undertake a study of its potential in terms of both scheduled and general aviation, particularly for the land-locked countries, since direct air services to and from overseas markets would greatly reduce the present problems of transport through neighboring transit countries. It is reported that the International Civil Aviation Organization (ICAO) may undertake such a study.

Animal Transport

3.27 The argument is often raised that animal transport is expensive, considering its low capacity in comparison with high maintenance cost. However, domestic animals such as horses, donkeys, oxen, and camels also perform other services, and many will remain on the farm anyway, even if so-called "first stop" transport were to be taken over by vehicles. Therefore, only the negligible marginal cost of animal transport should be considered in a comparison with the total economic cost of vehicles, and the higher standard roads needed to accommodate them. Animal transport still plays an important role in many areas of the world with a much higher level of economic development than prevails in the Sahelian region, and road investment plans should take this into account.

Ports

3.28 Four of the six Sahelian countries are land-locked, and only one, Senegal, has a protected commercial ocean port at Dakar. Mauritania, though

not land-locked, has only limited lighterage facilities at Nouakchott, and a small port, chiefly for handling iron-ore ships, at Nouadhibou in the extreme north. The southern populated part of Mauritania may be more economically served by the port of Dakar.

3.29 There are 13 ocean ports to serve the West African region: Dakar (Senegal), Conakry (Guinea), Abidjan (Ivory Coast), Lome (Togo), Cotonou (Dahomey), Douala (Cameroon), all in the so-called francophone countries, and Bathurst (Gambia), Freetown (Sierra Leone), Monrovia (Liberia), Takoradi and Tema (Ghana), Lagos and Port Harcourt (Nigeria), in the anglophone countries. There is little doubt that the combined capacity of these ports is sufficient to handle domestic exports and imports, plus the transit traffic of the land-locked countries, provided they are all efficiently managed and operated. However, there is a tendency for countries which became land-locked as a result of re-defined boundaries to give priority to port outlets in francophone countries which were historically in the same customs and currency area, without always due regard for minimum transport costs.

3.30 There need be no disagreement with the land-locked countries' desires to have more than one access to and from the rest of the world, if this is considered necessary to protect their economies from the consequences of possible traffic disruptions. On the other hand, placing too much emphasis on development of alternative access routes may tend to dissipate transport resources in both the land-locked and the transit countries. There is of course limited incentive for the latter countries to invest in transit facilities, either at the port of entry or in the transit route involved, unless a reciprocal benefit can be foreseen. Where international movements are relatively small, as is the case with the Sahelian countries, there is little scope for splitting traffic between several transit outlets, and at the same time offering incentives in terms of traffic revenues to the transit countries for developing facilities at ports and elsewhere on their transport systems. It would therefore serve the Sahelian countries best to designate their preferred transit ports for imports and exports.

3.31 Once this preference has been clearly established, port managements might be asked to set aside in their development plans certain bonded areas for the exclusive use of the land-locked countries, which eventually could be allowed to own and operate their own facilities if volumes warranted. Goods could then be moved through the transit countries in sealed containers by truck and/or railway wagon, thereby reducing customs problems. An arrangement of this type has been made by the port of Dakar for Mali, and this could serve as a prototype for other countries.

Storage Facilities

3.32 A serious problem encountered during the relief operations was the lack of storage facilities, as a result of which vehicles and planes were kept immobilized after arriving at inland distribution centers. Similarly, the ports and railways could not properly handle the excess traffic. Since a large share of normal imports are petroleum products, the same equipment and vehicles could not be used for grain being transported under the relief operations.

3.33 The purpose of storage is to spread peak demands on the transport system over longer time periods, thus avoiding the need for excess capacity in

each mode which would be idle most of the time; it follows that the location and capacity of storage facilities must be closely geared to expected traffic flows. It must be noted that the traffic pattern during the recent relief operations was quite different from that prevailing under normal conditions. Difficulties would have been avoided if the stream of imported foodstuffs through ports and over roads and railways could have been spread over about eight months rather than three. Under normal conditions, the production of such seasonal crops as groundnuts and cotton through local collection centers may arrive at a railhead or station within a period of about two or three months, and it would be inefficient for the railways to keep sufficient numbers of locomotives and wagons available during such a short period to transport the products to a port which could not handle such peak volumes. Therefore, in order to achieve spreading of traffic flows over time, adequate storage facilities are needed at ports, railheads, and collection centers.

3.34 There is one other point which makes storage an important factor in the transport system. For short distances, the advantage of reducing line-haul costs will frequently be offset by the high costs of inter-modal transfers which generally favor door-to-door road transport over rail service. In the Sahelian region, however, long distances and low labor costs make it more favorable to use multiple transport modes so as to minimize line-haul costs on each leg, since transfer costs are relatively low. An important factor in reducing transfer costs is to provide adequate storage facilities at transfer points. On this basis, it may be justified to carry out a study of storage facilities throughout the Sahelian region, based on normal rather than emergency conditions.

B. Transport Planning and Coordination

3.35 Most Sahelian countries are aware of the need for coordination in the planning of transport investments. Under prevailing conditions, however, planning to achieve minimum transport cost is difficult. Water transport may have the lowest cost per ton-km, but operations are possible for only about seven months a year or less, a distorting factor which is difficult to quantify. In the real world, it is the shipper rather than the economic planner who selects the transport mode. He is therefore free to choose more expensive road transport if the rail service offered is unsatisfactory. The planner will find it difficult to quantify and predict the value of service quality to the shipper which reflects such intangibles as travel time, frequency of service, schedule reliability and flexibility, loss and damage, etc. The selection of international routes may also depend on the performance of seaports. Further, the minimum cost transport solution assumes equally efficient operations by each mode, which may not be realistic in the short or medium term. This limits the accuracy of estimating minimum economic cost solutions to transport problems.

3.36 For the Sahelian countries, transport planning emphasizes roads, since rail track systems are not extensive, and the potential for river transport is limited. The major question is how to select road standards appropriate for the anticipated traffic flow. The possibility of stage construction allows for flexibility in planning, and errors are largely restricted to timing of the next stage. The conclusion therefore is that transport planning is more a matter of establishing priorities within each mode, rather than between them.

C. Special Problems of the Land-locked Countries

3.37 UNCTAD 1/ report TD/B/453 dated July 20, 1973 presents the findings and recommendations of an Expert Group which met in May 1973 to discuss the problems of transport infrastructure in the land-locked developing countries. The paper focusses on the problems which these countries have to face in carrying out foreign trade. The Group recommends that other experts be retained to prepare general guidelines in the following areas:

(a) improvement of transiting procedures and regulations by joint action;

(b) international joint ventures in the field of transport; and

(c) pricing in the transport sector.

The Group recognizes, however, that the proposed guidelines will only be useful if they are carefully adapted to the specific circumstances of these countries, especially in terms of their administrative capabilities and basic institutinnal features.

3.38 Although there may be general agreement with the underlying principles of the above, the question may also be raised whether it will be pragmatic to develop guidelines which are acceptable to all land-locked and neighboring transit countries involved, without them being at the same time so global and flexible that they are meaningless. There are 20 land-locked countries in the world, among them several which share with their neighbors arrangements which have over many decades been proven workable, for example, Bolivia and Paraguay in Latin America, and Afghanistan and Nepal in Asia. Of all the land-locked countries, 13 are in Africa, and the conditions among them vary widely. Some are developing countries with richer neighbors like South Africa. Others are prepared to pay more in order to avoid routes through countries they consider politically unacceptable. Finding a common denominator to fit these varying circumstances may prove extremely difficult. Four of the land-locked African countries are in the Sahelian region, and here also conditions are peculiar to them since: (a) they have only recently become land-locked, and (b) they have historic relations with most of their francophone neighbors, which they want to preserve, even though transit through other countries may in some cases be geographically more logical and economical.

3.39 It is therefore strongly recommended that these four Sahelian land-locked countries be used as a pragmatic test case for solving or at least reducing their individual transit problems, rather than attempting to develop transit guidelines which would also satisfy, for example, Paraguay, Nepal, or Zambia.

3.40 The most difficult issue is likely to be pricing. If a land-locked country pays the normal port tariffs and freight rates in the transit country, then theoretically all costs would be paid, provided there is no subsidy element involved in such charges. If subsidization is involved, however, the land-locked

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1/ United Nations Commission on Trade and Development

country would benefit from such a subsidy; and if some tariffs do not cover marginal cost, then the land-locked country's additional traffic would increase losses in the transit country. In the case of road transport, a trucking company of a land-locked country may enjoy the benefit of a road investment without appropriately paying for it, unless special arrangements are made. International joint ventures for railways and trucking companies may be one of several possible solutions to this problem.

3.41 A more complicated problem relates to the dependence of land-locked countries on the quality of transport infrastructure in transit countries. The terminal sections of road systems leading to the frontiers of these latter countries may be of little economic benefit to them, but may be at the same time a main artery for a land-locked country. Donor countries and international lending institutions would be in the best position to finance a project in country 'A' to the benefit of country 'B', but even when financing terms are soft, there is still the problem of allocations between the countries. Even if a project in country 'A' were financed as a grant, the allocation may still infringe on the resources available to country 'A' rather than country 'B'. This problem would be reduced if donors could agree to allocate a larger part of their funds to the West African region as a whole, rather than to specific countries. Concerning railways, reorganizing them into international joint ventures could be encouraged by making this a condition for their financing. The same principle applies to technical assistance; for example, there is little point in providing technical assistance to the Mali railways without at the same time making provision for improving operations of the Senegal railways; a joint venture would be the logical solution.

3.42 It has already been stated that the PISDCC does not represent the transit countries, and is therefore not the most suitable body to effect the required international transport planning. It can be argued that for this purpose the West African region should be considered as a whole, but it is impractical to try to reach agreement on priorities in about 15 countries. Consideration may be given, however, to dividing the region into, say, three geographically logical subregions for purposes of transport planning. One donor country reports that it has been asked to carry out a transport survey for the so-called Entente countries[1] plus Ghana; but it would seem to make little sense to exclude Nigeria from such a survey, since that country provides a logical access route for Niger.

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[1] Dahomey, Ivory Coast, Niger, Togo, Upper Volta.

4. NEED FOR ADDITIONAL STUDIES

4.01 A UNDP-financed Survey of African Regional Transport Studies was prepared by consultants Stanford Research Institute (US) in association with Intertransports (France) and Freeman, Fox, Wilbur Smith (England). Although the review of individual projects or subjects may now be somewhat out of date, the general text still makes very interesting reading for persons concerned with transport planning and financing. The report points to a considerable waste of resources on studies not particularly well suited to the problems involved. Of about 350 studies reviewed, only a few were sufficiently conclusive to permit an investment decision to be made, and even these required additional complementary studies. In future, every attempt should be made to avoid such a situation.

4.02 The Survey also provides many suggestions for improving the design and administration of studies. One of the major deficiencies identified by the consultants was the initiation of studies for specific transport projects without first identifying the likely flow of traffic to be generated by the facilities provided. This has led to a tendency to promote transport projects to fill superficially apparent needs (indicated merely by gaps on maps) which in actuality have a low priority. Another important observation is that there has been a strong tendency to make the scope of individual studies too broad for adequate coverage within the time and funds available, and that studies have often been initiated before the basic data needed for the analysis were available. This observation is particularly valid for the Sahelian region where statistics are scarce and deficient, and where development plans for the primary economic sectors are vague and subject to radical change.

4.03 In view of the above, this report refrains from making recommendations for specific project studies. Actually, many studies are already underway or contemplated, and further suggestions will probably be made by the several missions to the area.

4.04 A study has been underway on standards for low-class roads in Africa (principally gravel roads with a traffic density of 50 or more vehicles per day), with financing provided jointly by the UK Road Research Laboratory, the Government of Kenya, and the World Bank. A draft report is expected early in 1974, and the findings and recommendations should be useful for application to roads in the Sahelian region, even though traffic densities here are frequently much lower than those considered in the study. However, it may well be useful for the Sahelian region to carry out a practical test project to study the construction of cheap roads with materials largely available locally. Various soil stabilization techniques may be tried, for example, mixing soils with clay, silts, and calkine materials rather than the more usual and expensive bitumen, lime, or cement, since such techniques have been applied successfully in other parts of Africa.

5. CONCLUSIONS AND RECOMMENDATIONS

5.01 In spite of the transport difficulties encountered during the 1973 drought relief operations, the transport infrastructure of the Sahelian countries has a capacity to handle considerably larger volumes of traffic than it now does under normal conditions. Although there is much room for improvement, transport does not constitute a major bottleneck to development, and no spectacular development in the primary economic sectors would result from large transport investments. Investment priorities should focus on agriculture and livestock-raising, the main economic activities, with emphasis on the problems relating to the lack of water in the region, the high incidence of debilitating diseases, the low level of education, and the inadequate use of the limited potential for agricultural development.

5.02 The capacity of the existing transport infrastructure could be greatly increased without large investments if the existing facilities were improved and efficiently used and maintained. The primary goal should be to increase efficiency and reduce costs. Since distances are great in the Sahelian region, and particularly so for the important import-export trade, attention should be focussed on improving routes and services to and from the nearest sea-ports.

5.03 Traffic volumes in the Sahelian region are generally low and flows are varied, primarily because of (a) widely scattered centers of economic activities, (b) the absence of large cities, (c) low levels of agricultural activity and lack of other industry; and (d) scarcity of intraregional trade. New intraregional connections should be given low priority unless they form part of access routes to coastal countries and ocean ports.

5.04 Existing and foreseeable traffic volumes in the Sahelian region are, in general, too low to provide scope for expanding existing railway systems although in exceptional cases, such as the development of a substantial mineral deposit, a railway investment may be justified. However, long-distance rail transport should be more economic than existing road services in terms of ton-km carried and improved service quality would probably lead to increased use of rail services at low-marginal cost. The development emphasis in this mode should, therefore, lie with improving existing lines, motive power and rolling stock and, above all, with the improvement of management and operational efficiency. In this latter connection, joint-ownership or management of railways serving more than one country may be beneficial.

5.05 Although the region is traversed by three large river systems, the potential for river navigation is limited because of seasonal and unreliable flows, and because rapids make through-traffic impossible. Present and foreseeable traffic volumes are probably too low to justify sizeable investments for improvement of navigation. However, present uncertainties regarding the potential make it difficult for investment decisions on alternative transport modes; studies for river transport should therefore be advanced to a point where possibilities can be firmly established and decisions taken. Because of the sensitive features of the river systems, all potential projects for navigating irrigation, power and the like should be centrally reviewed by the same hydraulic experts.

5.06 Road transport is dominant throughout the Sahelian region and, to a considerable extent, on the access routes to ocean ports as well. Transport investment planning within the Sahelian countries is, to a large degree, a matter of establishing priorities for road development rather than inter-modal relationships. Most of the basic primary road network is already in existence and therefore, with a few exceptions, development should focus on maintenance and betterment work designed to rehabilitate and improve existing roads to economically justifiable standards. Much of this work could be done by force account backed by donor assistance in the form of recurring local budget support, equipment and technical assistance. Priorities should be assessed on the basis of analyses of potential flows and traffic volumes taking into consideration seasonal peaks and the effects of the rainy season on vehicular movements. Since traffic is fundamentally light and scattered, due consideration should be given to the continued use of animal transport to "first stop" collection points. Further, the use of special vehicles (jeeps, landrovers and 4-wheel drive trucks) over lightly-trafficked routes should be considered as an alternative to road construction. Small-scale air transport services could be considered in the same vein. Either method of transport might well have a lower economic cost to the countries than the construction and maintenance of roads into remote areas.

5.07 Four of the six Sahelian countries are land-locked and are dependent on transit through other countries for port access. Distances, even to the nearest port, are, in most cases, substantial and the impact of transport costs on both imports and exports is high. At the same time, the port and inland transport facilities required for these transit movements are not necessarily of prime concern to the transit countries, particularly where transit volumes are low and do not provide significant revenues to off-set the cost of facilities in the transit country. These disadvantages should be minimized by focussing, in each case, on access to the nearest suitable port and working towards long-term agreements for improved rail and road transit facilities and arrangements for special bonded receiving areas on the port. Donors might contribute substantially by earmarking aid for such routes and facilities on a multi-national or regional basis.

5.08 UNCTAD is actively studying the problems of land-locked countries (reference UNCTAD's report TD/B/453 of July 20, 1973 "A Transport Strategy for Land-locked Developing Countries). The four land-locked Sahelian countries could provide an excellent practical follow-up to this study.

5.09 Because of the long distances involved in traffic movements to and from the Sahelian countries, and the low volume and widely-dispersed traffic movements within the countries, the use of multiple transport modes may, in many cases, prove to be the most economic means of moving traffic. This can only be accomplished, however, if adequate storage facilities are available at strategic locations. Considerable scope exists for improving these facilities throughout the Sahelian region.

5.10 While various proposals suggested in this report may, if accepted, provide scope for a variety of studies, the author has refrained from specific recommendations for such undertakings.

SAHELIAN COUNTRIES

STRATEGY FOR TRANSPORT IMPROVEMENTS

Climatic and Socioeconomic Indicators

Indicator	Chad	Mali	Mauritania	Niger	Senegal	Upper Volta	Total
Total Area (Millions of Km^2)	1.28	1.21	1.08	1.27	0.20	0.27	5.31
Rainfall (% of area)							
Sahara (250 mm.)	51	44	71	60	-	-	52
Sahel (250 - 500 mm.)	10	27	15	30	21	8	21
Sudan (500 - 1000 mm.)	35	20	4	10	61	77	23
Guinea (1000 mm.)	4	9	-	-	18	15	4
Population 1/ (millions)	3.64	5.02	1.17	4.02	3.87	5.38	23.10
GNP per Capita 1/ (US$)	80	70	140	90	230	60	103
GNP per Capita Growth, 1960-70 (average annual % change in constant US dollars)	0.4	4.4	4.5	-2.0	0.0	-0.6	1.2
Share of Agriculture in GDP 1/ (%)	46	44	38	58	30	49	42

1/ 1970 estimates.

Table 1

Table 2

SAHELIAN COUNTRIES

STRATEGY FOR TRANSPORT IMPROVEMENTS

Production, Imports, and Exports of Principal Agricultural Products in 1970
(in '000 metric tons)

	Chad	Mali	Mauritania	Niger	Senegal	Upper Volta	Total
Millet and Sorghum							
Production	715	600	81	1,120	405	890	3,811
Imports	-	-	-	-	39	-	39
Exports	-	-	-	-	-	-	-
Groundnuts							
Production	115	158	-	235	537	68	1,113
Imports	-	-	-	-	-	-	-
Exports	85	18	-	158	537	8	806
Beef, Veal, Mutton and Lamb							
Production	66	83	42	75	46	44	356
Imports	-	-	-	-	-	-	-
Exports	36	n.a.	-	32	-	19	87
Cotton Lint and Cotton Seed							
Production	104	59	-	9	-	20	192
Imports	-	-	-	-	-	-	-
Exports	39	32	-	4	-	13	88
Other Principal Agricultural Products 1/							
Production	420	580	249	632	590	230	2,701
Imports	1	-	-	-	133	-	134
Exports	-	-	7	-	8	-	15
Total							
Production	1,420	1,480	372	2,071	1,578	1,252	8,173
Imports	1	-	-	-	172	-	173
Exports	160	50	7	194	545	40	996

1/ Includes milk, fish, rice, cassava and cow peas

Source: UNCTAD

SAHELIAN COUNTRIES

STRATEGY FOR TRANSPORT IMPROVEMENTS

Global Comparison of Economic Transport Costs (excluding taxes)
(in CFAF per ton-km)

	Asphalt Road[1]			Railway[2]			River Transport[3]		
Annual Tonnage	Infra-structure	Operations	Total	Infra-structure	Operations	Total	Overhead	Operations	Total
50,000	44	6	46	60	15	75	1.20	2.50	3.70
100,000	22	5	26	30	9.0	39	0.60	2.50	3.10
200,000	11	6	16	15	6.0	21	0.30	2.50	2.80
300,000	7.3	6	13	10	5.0	15	0.20	2.50	2.70
400,000	5.5	6	11	7.5	4.3	11.8	0.15	2.50	2.65
500,000	4.4	6	10	6.0	4.0	10	0.12	2.50	2.62
600,000	3.5	6	9.5	5.0	3.8	8.8	0.10	2.50	2.60
700,000	2.8	6	8.8	4.3	3.5	7.8	0.09	2.50	2.59
800,000	2.5	6	8.5	3.8	3.3	7.1	0.08	2.50	2.58
900,000	2.2	6	8.2	3.2	3.1	6.3	0.07	2.50	2.57
1,000,000	2.0	6	8.0	3.0	3.0	6.0	0.06	2.50	2.56

Table 3

1/ Based on table in para. 3.11 of the main report.

2/ Assumed construction cost of fixed facilities CFAF 30 million (US$130,000 equivalent) per km., annuity 40 yrs., 10% interest. Figures based on long average haul and efficient operations. Infrastructure cost will vary greatly with terrain conditions.

3/ Based on a 1970 study by consultants NEDECO (Netherlands) for river transport Niamey-Port Harcourt (adjusted for cost increases); overhead includes river management, improvements; operations include harbor duties and storage; 400-ton barges.

Transport Conditions in the Sahelian Countries

1. Transport conditions in the six Sahelian countries are individually described and discussed in this Annex to provide some counterpoint and detail to the regional presentation in the main text. Local economies, and the problem of the drought, are similar in all the countries. However, their individual transport problems vary somewhat, depending on the relative ease of access to Atlantic Ocean ports, and the incidence of rail and river facilities.

Chad

2. Chad is a vast, very poor, landlocked country which depends on cotton and livestock production concentrated in the Chari River basin in the south. The remaining northern 90% of the country consists of desert and Sahelian grasslands. Transportation plays a critical role in the economy, and the lack of adequate international connections constitutes one of the prime obstacles to development. Trade is dependent on long external routes using multiple modes. The resulting high transport cost inflates the domestic prices of imported inputs and consumption goods, and threatens to hamper the development of exports.

3. Internal transport is generally inadequate due to poor, insufficiently maintained roads, and the seasonal variations of water transport. There is no railway. The highway system consists of 7,232 km of classified roads (232 km paved) and about 25,000 km of unclassified tracks. The riding quality is generally poor. Water transport, although seasonal, was more important in the past when all roads were primitive; it is now concentrated on the Chari River between Lake Chad, N'djamena, the capital, and Sarh, and accounts for only about 5% of total transport activity. There is an international airport at N'djamena, and a local airline company operates scheduled services between the four principal towns.

4. Chad relies on four major transport routes to the sea, and pursues a policy of dependence on no single route. These routes are as follows: (a) Trans-Equatorial rail, river and road system from Pointe Noire (Congo) through Bangui (C.A.R.) to southern Chad; (b) the Trans-Cameroon route from Douala to N'Gaoundere, from where it connects by a road system still under construction to Moundou and Bongor and N'djamena; and (c) the Nigerian routes, the main one from Nigeria's sea ports by rail to Maiduguri and then by road to N'djamena, and the secondary one over the seasonally navigable Benoue river through northern Cameroon by road to the cotton zones in southern Chad.

5. Transport infrastructure absorbed about 23% of public investment during the 1966-70 Development Plan. Over 90% of this amount was for roads, particularly in the south. Unfortunately, road transport costs have not been significantly reduced as a result, although the reliability of service during the rainy season has improved.

6. The development prospects for river transport are limited, and air transport handles almost exclusively meat exports and high value imports. Domestically, air transport offers potential for the Chadian economy, but the infrastructure of secondary airports is generally deteriorated. Low traffic levels in certain regions, mostly north and east of the Chari River, do not justify large investments in land transport, and air services are seen as a reasonable alternative to ensure the flow of goods and services to these areas.

Mali

7. The larger northern part of landlocked Mali is desert. Most of the population lives in the southwest where most economic activities are concentrated, and along the Niger River. Because of the low population density, distances are long and traffic volumes are low. Of the seven countries bordering Mali, only two (Senegal and Ivory Coast) provide connections to the Atlantic to handle overseas trade; capacity is adequate only if both routes are used. The distance from Bamako to either Dakar or Abidjan is about 1,200 km; distances to either Conakry (Guinea) or Freetown (Sierra Leone) would be shorter, but these ports are not being used.

8. Mali has a fairly extensive transport system which serves most of the country adequately. The physical infrastructure consists of: (a) a 640 km railway which links Bamako via the Senegal Railway with Dakar; (b) about 1,650 km of inland waterways which are, however, navigable only seven months of the year, and because of rapids and rock outcroppings beyond Gao, do not provide river navigation all the way to the river's mouth in Nigeria; (c) a 13,000 km road system, of which 3,100 km are all-weather and 1,630 km paved, with the rest a scattered network of secondary gravel roads and tracks. There is an international airport at Bamako, and about a dozen airfields which serve domestic commercial needs.

9. The transport infrastructure is generally adequate if used efficiently. The condition of the primary roads can serve present traffic levels, although several older paved roads need strengthening and rehabilitation. The secondary road and track system is in less satisfactory condition. Highest priorities are for adequate maintenance, and for improvement of the secondary network.

10. The Government exercises considerable control over the transport system. Public ownership applies to the Malian railroad; a trucking company which carries about 20% of total road freight; a navigation company handling about 70% of waterway traffic; and Air Mali, the only internal carrier. The key elements of transport regulation are: (a) centralization of transport demand for imports, exports, and all domestic road haulage through Government-administered freight offices and (b) control of all freight rates.

11. Notwithstanding the Government control of the transport industry, its performance is less than satisfactory because of misuse of the system. There is ample scope for increasing railway capacity, but improvements in operations can be successful only if the Senegal Railways are similarly improved. In recent years, the road vehicle fleet has grown at a faster rate than the economy, but output is much too low; average annual truck kilometrage is only about 25,000 km. The fleet suffers from inadequate maintenance and from overloading. In general, the poor condition of the railways and the trucking fleet are the direct result of inadequate levels of Government-controlled freight rates and inefficient operations.

Mauritania

12. Agricultural activities in Mauritania are of necessity concentrated on a narrow strip of land along the southern border. Agricultural production is heavily dependent upon favorable weather conditions (rainfall and over-flooding of the Senegal River), as was dramatically proved by the recent drought which caused an estimated 60% drop in cereal production. The only major economic activity possible in Mauritania's Sahel region is the raising of large herds of cattle, sheep, and goats, and this activity provides the main source of livelihood for 70% of the country's population. The drought has forced a substantial number of nomads to seek refuge in the towns where populations have now increased sharply. The possibilities for early departure of these nomads are limited, as it is expected to take about a decade before livestock herds can be rebuilt to pre-drought levels. Enclave mining and fishing activities have developed in the northern areas of the country at Nouakchott, Port Etienne, Akjoujt, and Fort Gouraud, but have had little effect on the population concentrations in the south.

13. Historically, the transport system of Mauritania was designed to link population centers with the major port of Dakar in Senegal, the import/export gate. The majority of the population located in the flood plain of the Senegal River was served either by river transport, or by the Senegal-Mali Railway which passes close to the Mauritanian frontier. Road transport and the traditional camel caravans were used to provide the limited onward movements from small river ports to more inaccessible areas. A main road running north from Rosso, the principal Senegal River port, offered access to the sparsely-settled semi-desert areas lying hundreds of kilometers away.

14. When the new lighterage port at Nouakchott was completed in 1966, traffic movements were diverted from the Dakar-oriented pattern, and a considerable reversal occurred in the northward flow over the Rosso-Nouakchott road, as imports tend to enter through Nouakchott rather than Dakar, and to move south or north from that point. However, movements through the more populated south and southeast remain largely unaffected by this change, because traffic destined for this area, regardless of whether it originated at Nouakchott or Dakar, must pass through Rosso and utilize the traditional river or road system (or both) to its ultimate destination. Sea-port facilities are also located at Port Etienne in the north, primarily for export of iron ore.

15. The road system totalled about 6,000 km in 1967, of which 3,200 km are national routes and 2,800 km are dirt tracks serving the various sub-divisions. Most of the roads are in poor condition. About 6,000 motor vehicles were in operation in that same year, of which about 3,700 were buses, trucks, and other heavy vehicles.

16. There is only one railway which covers the 670 km distance between the iron ore deposits near Fort Gouraud and the export outlet at Port Etienne. The railway is privately owned and operated, and traffic is largely confined to iron-ore movements, with small amounts in imported general traffic.

17. The organized waterway services on the Senegal River consist of a few powered craft and barges. On the Mauritanian shore, several primitive ports provide manual loading and unloading facilities for the powered vessels and for small itinerant craft. The river is seasonally navigable from Rosso to Kaodi.

18. Mauritania has a relatively well-developed air service network, with 12 airports capable of handling four-engined aircraft, and 10 other fields. Local air services play an important role by compensating for the lack of adequate surface communication to remote or seasonally isolated areas.

19. Transport development policy has so far been appropriately confined largely to the maintenance and gradual improvement of the existing road network. Mostly for political reasons, the Government is planning early construction of a paved road from Nouakchott to Boutilimit, and re-alignment and paving of the Boutilimit-Aleg-Kiffa-Nema roads. However, traffic might not be sufficiently high to make these projects economically justified, since the roads would bypass important agricultural regions. The Government is also considering construction of a deep-sea port at Nouakchott to further lessen the country's dependence on Dakar. The existing wharf at Nouakchott has a capacity of 250,000 tons, but in 1972 handled only 120,000 tons. Dry cargo traffic shipped through Dakar totalled only some 10,000 tons in 1972, and if this were diverted to Nouakchott, the economic justification for a new port would not be significantly enhanced.

Niger

20. Niger is one of the largest landlocked countries in Africa. The northern 90% of the country is desert, a low plateau in the Saharan and sub-Saharan regions. The population is therefore largely concentrated on a strip of land over 1,000 km long in the extreme south; the urban population is still small. Long distances both within the country itself and to the nearest ocean ports burden the economy with high transport costs. There are three main outlets to the sea:

(i) The Dahomey route (about 450 km from the Niger border to the sea) which connects Gaya by road to Parakou, and by rail to Cotonou;

(ii) The Nigeria route (about 850 km) which connects the central and eastern regions by road to Kano, and by rail to the port of Lagos; and

(iii) The Ivory Coast route (about 1,650 km) which connects Niamey by road to Ouagadougou (Upper Volta), and by rail to Abidjan.

Achieving reduction of Niger's external transport costs will depend on improvement in transport facilities in these neighboring countries.

21. About 80% of the groundnuts for export are usually routed to Kano in Nigeria, and from there via the Nigerian Railway to Lagos. Most of the remainder are exported through Dahomey under regulation by the Organisation Commune Dahomey-Niger (OCDN) formed by the two countries in 1959. OCDN operates the Parakou-Cotonou railway, and has the exclusive right to charter road transport for evacuation of that portion of the groundnut production routed through Dahomey. The amount to be exported over this route is determined at the beginning of every crop season; however, the volume actually shipped via Dahomey has been larger in some years when there were capacity problems on the Nigerian Railway.

22. Niger's internal transport system consists essentially of a road network. The system includes about 7,300 km of roads of generally low design standards. There are about 500 km of bituminous roads, of which 400 km have a sufficiently wide pavement (6 or 7 m) to permit two-lane traffic. About 40% of the national road system is gravel-surfaced. Most gravel roads are considered to be all-weather, but many are closed to truck traffic after heavy rains. In the sparsely populated north where transport requirements are limited, the volume of freight is too low to justify the infrastructure costs of modern highways. Camels are the most economical form of transport, even though their operating cost per ton-km is two to three times higher than that of trucking. The number of road vehicles was about 10,000 in 1972, increasing annually at about 11% on average.

23. There is no railway, and water transport on the Niger River is at present of little significance. Internal air traffic, though increasing in volume, is relatively light; international air traffic is through the airport at Niamey.

24. In general, Niger's transport infrastructure can be considered adequate provided it is efficiently maintained and operated. Improvements of road links to railheads in Nigeria seem warranted. Recent declines in rail traffic are attributable to deficiencies in management, to the unsatisfactory rate policy, and to competition from road transport.

Senegal

25. Senegal is the smallest of the countries. The population is largely concentrated in the west, and a considerably larger share lives in urban areas (29%) than in the other Sahelian countries (5 - 10%). This fact has its effect on traffic patterns: distances are shorter, especially to the Atlantic port of Dakar, and there are larger flows of food supplies from rural to urban areas.

26. Senegal has a fairly well developed transport system, due partly to its historically central position in the former French West Africa, and partly to the emphasis of its Development Plans since independence in 1960. Most of the 9,100 km of roads and 1,032 km of railway lines are oriented toward Dakar, which is the only protected commercial deep-water port among the Sahelian countries, and which also provides primary transport access for landlocked Mali.

27. The road network is concentrated in the western one-third of the country, the area of primary economic activity. About one-quarter of the roads are paved, and a further one-third are all-weather gravel and earth roads.

28. The railway system comprises about 660 km of heavily travelled main trunk line between Dakar and Mali, and about 370 km of branch lines. The main line carries an estimated 36% of Mali's exports and 63% of its imports, and this traffic generates about 52% of the system's gross revenues. Other major freight traffic includes phosphates and groundnuts; passenger traffic has declined recently with expansion of the road network and the vehicle fleet. The railroad still accounts for about 65% of total freight carried, but is suffering from management and operating problems, and performance is unsatisfactory.

29. Little use has been made of the Senegal and Gambia Rivers for transport, and coastal shipping is not significant. Dakar serves as a major international airport, and a national airline provides service to a dozen outlying towns.

30. The transport infrastructure absorbed about 26% of public investment between 1968 and 1971. Foreign aid, in turn, accounted for 58% of 1971 public investment, and is expected to increase in the future. Transport investments supported by foreign aid have included, inter alia, highway projects emphasizing maintenance and feeder road construction; railway projects for purchase of new equipment, rehabilitation of existing items, and management improvement; and an operation for extension of port facilities at Dakar.

31. Several needs can be identified for future transport investment:

(i) The construction of feeder and farm-to-market roads as an aid to agricultural development;

(ii) Improving the efficiency of existing rail services to cater for the resumption of substantial groundnut shipments in 1972 following the loss of preference in the French market; and

(iii) Solving the many problems in the area of inter-modal coordination (pricing, investment, and entry regulation) which hamper the transport system. Approximately 80% of traffic is however captive to rail, including block train bulk (phosphate) and international traffic to Mali.

Upper Volta

32. Stagnating overall exports and growing imports have caused a large trade deficit in landlocked Upper Volta. During the last few years, rising cotton exports helped diversify the country's export structure traditionally dominated by livestock products. At the same time, however, adverse weather and health conditions, as well as lack of investment and operational funds, have resulted in a significant decline of livestock exports.

33. Transport within the country is primarily by road. The system consists of about 8,900 km of classified roads, and about 8,000 km of rural tracks. The network of primary roads (4,450 km) radiates from the capital, Ouagadougou, and from the main commercial center, Bobo Dioulasso, and largely satisfies the current needs of the country. About 385 km of these roads are paved, with the remainder gravel surfaced. The latter are considered to be all-weather, although the unpaved sections are generally closed to heavy traffic for short periods after heavy rains. Maintenance is carried out only on the primary network, and the other roads have deteriorated over the past decade to little more than trails. The secondary and tertiary roads are passable to heavy trucks and four-wheel drive vehicles, but only during the dry season; the rural tracks are used largely by bicycles, porters, and pack animals.

34. The most important international transport connection is the railway linking Ouagadougou with the seaport of Abidjan (Ivory Coast), a total distance of 1,145 km. The railway is a semi-autonomous agency jointly owned and operated by the Governments of Upper Volta and Ivory Coast. Some 2.5 million passengers and 756,000 tons of goods were carried in 1970, with Upper Volta traffic alone accounting for over half of total passenger-km and ton-km. Transit traffic to and from Mali represents about 20% of total ton-km. Purely internal traffic utilizing the 518 km of track within Upper Volta is low, not less than 25,000 tons in 1970.

35. Both Ouagadougou and Bobo Dioulasso have international airports. Internal air transport is negligible. A small domestic airline was created by the Government and private interests in 1967, but it has not yet been able to operate profitably due to the lack of demand.

36. The Government has been giving investment priority (dependent on external sources) to the improvement of international road links with Mali, Ghana, and Togo. The roads between Bobo Dioulasso and the Mali border, and between Ouagadougou and the Ghana border have recently been paved with external financing, and work on the Ouagadougou-Togo border road is underway. The Government's decision to upgrade the road links with Ghana and Togo has been based mainly on a desire to create alternative outlets to the sea and reduce the country's dependence on the railway connection to Abidjan. This rail link generally operates efficiently and, except for short periods of peak demand, has sufficient capacity to handle the requirements of external transport. The railway is at present the most economic route to the sea for the western and central areas of the country where economic activity is concentrated.

37. Future transport investments in Upper Volta include construction of additional trunk roads, rehabilitation of existing secondary roads, and construction of transport links to the Tambao ore project if this materializes.

38. Investments should also concentrate on maintenance of existing secondary roads, and the construction/reconstruction of some primary roads where economically justified. Continued upgrading of the railway in the Ivory Coast is recommended.

IBRD 10604 R

OCTOBER 1973

WEST AFRICA
DROUGHT RELIEF FUND PROJECT

SAHELIAN ZONE COUNTRIES

750 — MEAN ANNUAL RAINFALL (ISOHYETS IN MILLIMETERS)

22 RAINFALL COEFFICIENT OF VARIABILITY

— — — MEDIAN

	ECOLOGICAL ZONES	ISOHYETS IN MILLIMETERS
I	GUINEAN AND FOREST ZONE	ABOVE 1000
II	SOUDANIAN	500–1000
III	SAHELIAN	250–500
IV	SAHARIAN	0–250

— · — INTERNATIONAL BOUNDARIES

⊛ CAPITALS

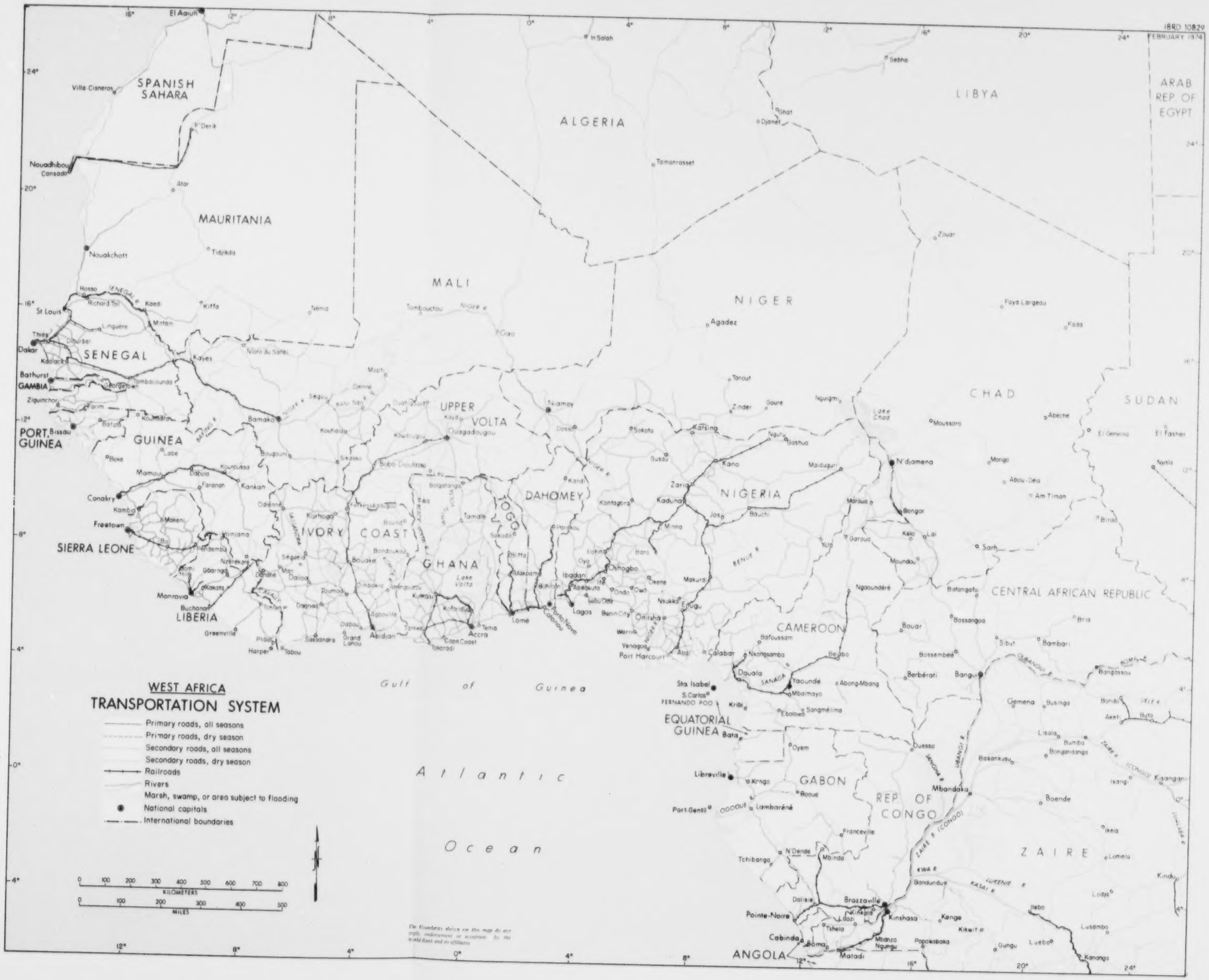
0 200 400 600 800 KILOMETERS

0 100 300 500 MILES

The boundaries shown on this map do not imply endorsement or acceptance by the World Bank and its affiliates.

MOROCCO
ALGERIA
TUNISIA
LIBYA
MEDITERRANEAN SEA
CRETE
BENGHAZI
CANARY ISLANDS
SPANISH SAHARA
EL AIUN
RABAT
MAURITANIA
NOUAKCHOTT
SENEGAL RIVER
SENEGAL
DAKAR
BANJUL
GAMBIA
BISSAU
GUINEA-BISSAU
GUINEA
CONAKRY
SIERRA LEONE
FREETOWN
LIBERIA
MONROVIA
IVORY COAST
ABIDJAN
ATLANTIC OCEAN
GULF OF GUINEA
UPPER VOLTA
BAMAKO
NIGER RIVER
OUAGADOUGOU
GHANA
LAKE VOLTA
TOGO
DAHOMEY
LOME
PORTO NOVO
ACCRA
LAGOS
NIGERIA
NIAMEY
KAINJI RESERVOIR
BENUE RIVER
NIGER RIVER
LAKE CHAD
BAHR EL GHAZAL
N' DJAMENA
NIGER
CHAD
SUDAN
CAMEROON
CENTRAL AFRICAN REPUBLIC
BANGUI
SANGHA RIVER
YAOUNDE
EQUATORIAL GUINEA
BATA
GABON
CONGO
ZAIRE RIVER
ZAIRE
UGANDA
250
500
750
1000
1250
I
II
III
IV

IBRD 10829
FEBRUARY 1974



WEST AFRICA
TRANSPORTATION SYSTEM

- Primary roads, all seasons
- Primary roads, dry season
- Secondary roads, all seasons
- Secondary roads, dry season
- Railroads
- Rivers
- Marsh, swamp, or area subject to flooding
- National capitals
- International boundaries

0 100 200 300 400 500 600 700 800 KILOMETERS
0 100 200 300 400 500 MILES

The boundaries shown on this map do not imply endorsement or acceptance by the World Bank and its affiliates.

SPANISH SAHARA

MAURITANIA

ALGERIA

LIBYA

MALI

SUDAN

NOUADHIBOU

FOERIK

ATAR

NOUAKCHOTT

SAINT-LOUIS

SENEGAL

DAKAR

THIES

KAOLACK

KAYES

SEGOU

BAMAKO

OUAGADOUGOU

NIAMEY

ZINDER

N'DJAMENA (FORT-LAMY)

SARH (FORT-ARCHAMBAULT)

PORT. GUINEA

BISSAU

BOBO-DIOULASSO

GUINEA

CONAKRY

SIERRA LEONE

IVORY COAST

GHANA

TOGO

DAHOMEY

NIGERIA

FREETOWN

MONROVIA

LIBERIA

ABIDJAN

ACCRA

LOMÉ

COTONOU

LAGOS

CAMEROON

YAOUNDÉ

CENTRAL AFRICAN REPUBLIC

BANGUI

SAHELIAN COUNTRIES

1 : 5 000 000

0 100 200 KM

Population Distribution

NOMADS
2 000 INHABITANTS

SETTLEMENTS
2 000

TOWNS
10 000 - 25 000
25 000 - 50 000
50 000 - 100 000
100 000 - 200 000
MORE THAN 500 000

SEASONAL ROUTES OF NOMADS

NORTHERN LIMIT OF SETTLEMENTS

O.C.D.E.
CENTRE DE DEVELOPPEMENT
Y. PONCET
MAI 1973